Exploring mathematics: maths in nature and art

Visualising a conic

Pointing a torch beam at a wall will produce a cone of light. And where the cone intersects or meets a flat wall the light produced traces out what we call a **conic section**.

If the torch is pointed straight on to the wall, then that conic section is a **circle.**

Tilting it slightly produces an **ellipse**.

As it's tilted yet further, the ellipse becomes more and more elongated. Until eventually the curve stops being a closed curve. At this point the outer edge of the beam becomes parallel to the wall and the outer curve is a parabola.

As the beam is tilted even more the arms of the curve spread out, giving a hyperbola.

All these rather different curves, the circle, the ellipse, the parabola and the hyperbola, come from the **same** experiment.

From looking at the shape we get when a plane, like the wall, cuts a cone.

So they are all members of a continuous family of curves. They are all conic sections.

To end this part of the video, these conic sections are demonstrated on a physical model of the cone, on some historic film of one of the great mathematics teachers of this century, Bartel van der Waerden.

Here I have a cone. If we intersect this cone by a plane parallel to the base plane then we get, as an intersection, a circle you see that's obtuse.

Now let's put it together again. But if we intersect the cone by a plane in a skew position like this, we get an ellipse.

Now I'm always astonished that this intersection has not the shape of an egg. It is just as large here at the bottom as on the top. This is an ellipse.

But if on the other hand if we intersect the cone by a plane parallel to this tangential plane then we get a curve which is called parabola.